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ABSTRACT

This study examined the effects of color and light on the learning of eleven 6-year-old elementary school students. The students were videotaped to identify off-task behaviors and had their blood pressure measured while in a standard classroom with white walls and cool-white fluorescent lights, as well as in a classroom with light blue walls and full-spectrum Duro-test Vita-lite lights. The study found that the students accumulated a total of 390 off-task behaviors in the standard classroom compared to 310 in the modified classroom, a decrease of 22 percent. It also found that students' mean blood pressure readings were nine percent lower in the modified classroom when compared to their readings in the standard classroom. (MDM)

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ED 382 381

Color and Light Effects on Learning

Ellen Mannel Grangaard

Man is a sensory creature continually reacting to the stimuli within his environment. It is said that the environment educates because the learner interacting with the environment will be more or less motivated, more or less productive as determined by the elements of his environment. "Psychophysics involves attempts to measure the relationship between sensory experience and the physical stimulus energies arising from the environment." [1] Farmers and biologists have manipulated the environments of plants and animals for years in attempts to create bigger, healthier products for the market. "The human learner is the product with the greatest profit potential, the product whose improvement most benefits mankind, yet it is the product whose environment has remained sterile, bereft of stimuli or bombarded by stimuli, in classrooms of industrial white with inadequate lighting." [2]

In September of 1992, a study to determine the physiological and behavioral effects of color and light on six year old children took place at C.H.Decker Elementary School in Clark County Nevada. This study was the replication of a study which was conducted by Dr. H. Wohlfarth in Edmonton, Canada in 1981. The subjects of Dr. Wohlfarth's study were seven children with behavioral problems who were housed within a closed environment; the subjects in this study, five 6-year old boys and six 6-year old girls, were children in a public elementary school setting who were in and out of the test field several times each day.

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The research proceeded through three separate phases in which the color and light of the test field was manipulated. The first phase was the original environment which consisted of the standard classroom visual noise on the walls, bulletin boards of red and orange and white semi-gloss walls with cool-white fluorescent fixtures. The second phase was the test phase in which the walls were painted a light blue, the visual noise was returned to the walls and the lights were changed to a full-spectrum Duro-test Vita-lite. During the third phase the original environment was reinstated.

During the three phases, each of which lasted for ten days, the children were video-taped for 15 minutes in the morning at the same time each day during the same activity and for 15 minutes in the afternoon. The children's blood pressure was also taken at the same time each day, once in the morning and again in the afternoon.

Video-taping and the measuring of blood pressure began two weeks prior to the actual research in order to acquaint the subjects with procedures.

The blood pressure readings were taken with an Automatic Digital Blood Pressure/Pulse Monitor with a tape print-out. The blood pressure monitor was factory calibrated and calibrated manually by having the school nurse take blood pressure readings.

Systolic blood pressure readings were computed for the tables and the computer generated graphic representation because the systolic blood pressure is most responsive to changes in the

environment.

Group mean blood pressures decreased dramatically by 9% during the test field (psychodynamically prescribed environment) with a gradual increase of 1% when the field was returned to the original environment.

Three educators were trained in procedures to count the off-task behaviors to be identified from the video tapes. The films that were made during the period before the actual study began were used during the training sessions. The three observers were an early childhood specialist, a first grade team teacher and an elementary school counselor each having Master's Degrees in their specialties and more than ten years in the educational milieu.

The study began with 18 subjects which was the total classroom population. Due to classroom equalization the classroom population increased over the first three weeks. At the culmination of the study only the readings of children who were in continuous attendance during the study were utilized in the data.

Even though the training emphasized consensus in determining off-task behaviors, there was a high discrepancy rate between the classroom teachers and the school counselor. The classroom teachers felt that they could more easily discriminate actual off-task behaviors whereas the school counselor might not allow subjects the same amount of leeway. This could have created a discrepancy in the data; however, the change in the off-task behavior during the test field was so significant and the

observers were each so close in the percentage of behaviors observed during each of the three phases that it appears unlikely to have changed the findings of the data.

The off-task behaviors to be identified were:

1. The child is not visually following the lesson being presented.

2. The child appears to be attending, but is playing with objects.

3. The child is moving the chair or his body in a way which precludes his being able to concentrate on the lesson.

4. The child appears to be daydreaming, is not involved in the lesson.

5. The child is covertly bothering the children around him while appearing to be involved in the lesson.

6. The child is overtly acting out-not attending to the lesson.

A total of 1110 off-task behaviors were counted during the seven weeks of the study. Three hundred ninety off-task behaviors were counted during the first phase (original environment) which was compared to three hundred ten off-task behaviors counted during the second phase (test field), a decrease of 22%. This decrease was recorded during the time when the only change in the environment was the color and the lights in the classroom.

During the third phase (original environment) an increase of 1% in off-task behaviors was recorded by the observers which

appears to demonstrate the same carry-over as in the blood pressure readings and in the replicated study.

The subjects in Dr. Wohlfarth's study displayed a flat abscissa in the blood pressure readings during the test field, whereas the Clark County Study was erratic. This is thought to be attributed to the time spent in the environment. The students in the public elementary school were in and out of the test field several times each day which was in sharp contrast to the Edmonton study in which the students spent the major part of their day in the environment.

A nine percent decrease (9%) in the mean blood pressure readings was recorded when the test field was instituted during Phase 2 of the study with a slight increase recorded during Phase 3 in which the field was returned to the original environment.

Computer generated graphs demonstrated Phase II coordinates as being lower each day of the study with the exception of two days. Readings during Phase I ranged from a high of 106 to a low of 89; Phase II readings reached a high of 98.5 from a low of 81.5 with Phase III remaining low, 90 to 94.5 as it had in Dr. Wohlfarth's original research suggesting a carryover.

Because the childrens' blood pressures were taken twice a day, several cases of possible childhood hytertension were reported, an unexpected side benefit of the research.

Despite the lack of extensive research concerning the physical aspects of the educational environment, it is the learning environment within which humans spend a large part of

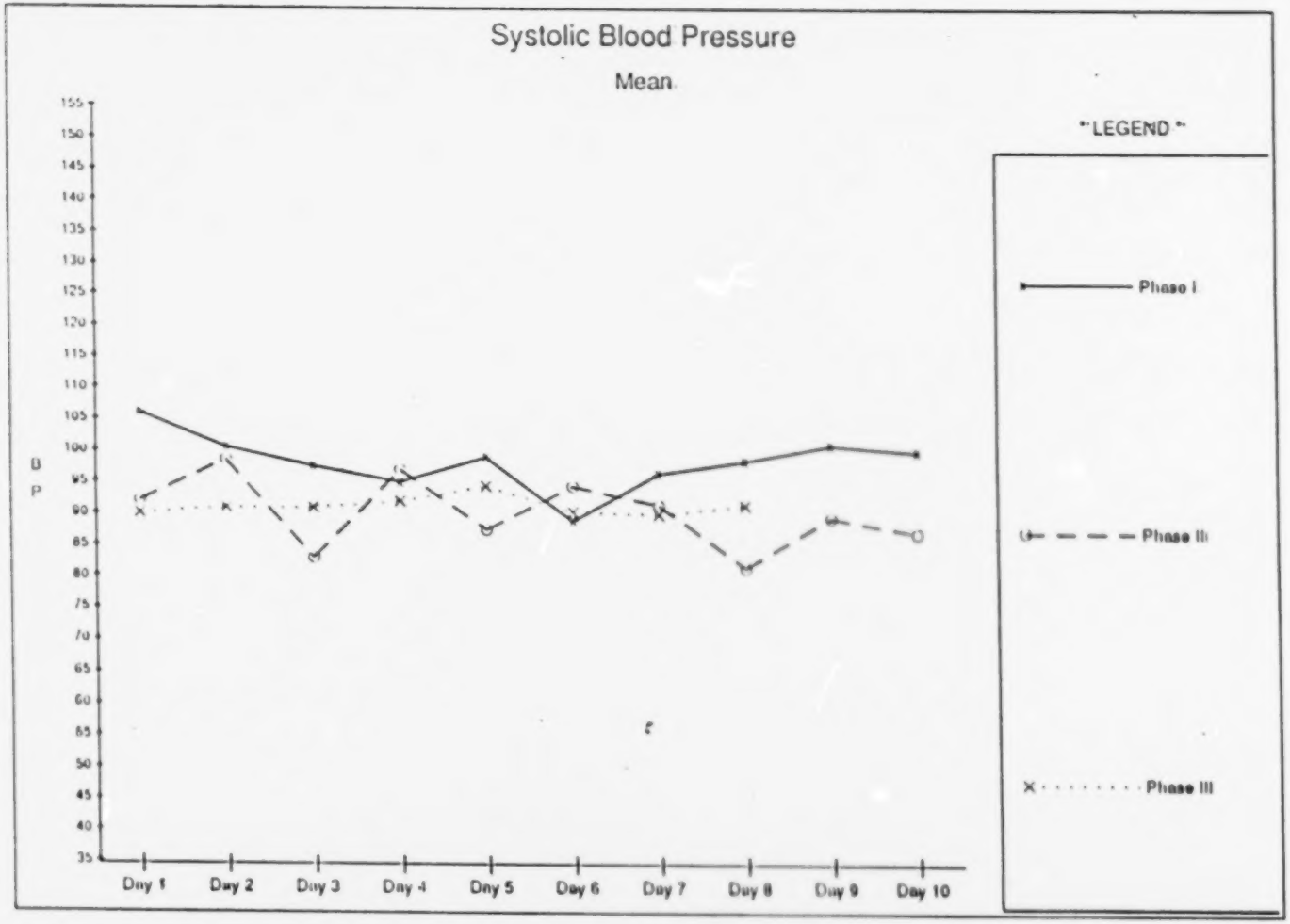
their lives, the most important part. Research has demonstrated the fact that there is a cause/effect relationship between the biological organism and its environment, although the measuring of that effect is often necessarily qualitative. The importance of this relationship can be ascertained by scrutinizing the measure of those who have contemplated it, Newton, Goethe, Aristotle and those in the twentieth century who have utilized sophisticated instruments and computers.

The enhancement of human performance requires the optimum environment. Educators must recognize the fact that surroundings are never neutral. Just as the teacher and the materiel set the stage for learning, the milieu becomes a part of the tableau which creates a user-friendly school. [3]

1. Bennett, Thomas L. (1978). The Sensory World. An Introduction to Sensation and Perception. California: Brooks/Cole Publishing Company.

2. Grangaard, Ellen. (1993). "Effects of Color and Light On Selected Elementary Students." Doctoral Dissertation-University of Nevada-Las Vegas.

3. Hathaway, Warren. (1988 Winter) Designing to Enhance Learning and Human Performance. Education Canada.


Systolic Blood Pressure
Mean
B
P
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8
Day 9
Day 10
"LEGEND"
Phase I
Phase II
Phase III

Off-Task Behaviors As Recorded by Three Observers

Phase I

Day	1	2	3	4	5	6	Totals	
Judge A	10	13	15	15	23	22	98	25%
Judge B	40	38	43	22	19	28	190	48%
Judge C	23	26	17	17	12	16	111	28%
Totals	73	77	75	54	54	66	399	
Daily Mean	24.3	25.7	25	18	18	22		

Phase I Mean 66.5 Standard Deviation 7.33

Phase II

Day	1	2	3	4	5	6	7	Totals	
Judge A	12	14	8	16	11	13	12	86	25%
Judge B	29	34	30	23	25	30	29	200	56%
Judge C	12	16	11	12	8	6	5	70	20%
Totals	53	64	49	51	44	49	46	356	
Daily Mean	17.7	21.3	16.3	17	14.6	16.3	15.3		

Phase II-Mean 50.8 Standard Deviation 5.05

Phase III

Day	1	2	3	4	5	6	7	Totals	
Judge A	17	16	13	15	14	16	14	105	29%
Judge B	24	30	19	23	26	34	18	174	49%
Judge C	12	12	13	13	4	10	12	76	21%
Totals	53	58	45	51	44	60	44	355	
Daily Mean	17.7	19.3	15	17	14.7	20	14.7		

Phase III-Mean 50.7 Standard Deviation 5.17